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RONALD ROSS

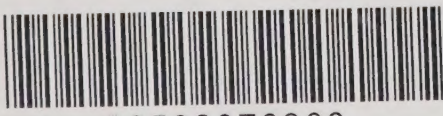
1857-1932.

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OBITUARY.

COLONEL SIR RONALD ROSS,
K.C.B., K.C.M.G., M.D., D.Sc., LL.D., F.R.C.S., F.R.S., I.M.S. (retd.),
1857—1932.

Sir RONALD ROSS, President of the [Royal] Society of Tropical Medicine and Hygiene from 1909 to 1911, and recipient of the Manson Medal in 1929, died at the Ross Institute on 17th September, 1932, at the age of 75, after a long illness. He was buried at Putney Hill Cemetery, not far from the Institute founded in his honour and beside his wife, who had died in the previous year.

Ross will ever be remembered as the discoverer of the method of spread of malaria by mosquitoes—a discovery which not only solved the problem of the etiology of the most wide-spread of human diseases, but placed in the hands of sanitarians methods by which this disease might be greatly reduced, if not completely eradicated.

The great discovery was the final result of researches which Ross had commenced in India in 1895 after he had already spent fourteen years in Madras, Burma and the Andamans in military service. During these years medicine and research appear to have interested him less than novel writing, poetry, music and mathematics, but some indication of the course he was destined to follow occurred on his first leave in 1888 when he obtained the Diploma in Public Health and studied bacteriology under KLEIN. He thereby gained some knowledge of microscopical technique, which, however, proved insufficient to enable him on his return to India to find the parasite of malaria described by LAVERAN in 1880. Indeed his unsuccessful endeavours merely led him in various scientific publications to throw doubt on the accuracy of LAVERAN's discovery.

In 1894 Ross returned to England for his second leave and then occurred the historic meeting with PATRICK MANSON and the foundation of that intellectual partnership which was to culminate in the discovery of the method of spread of malaria. MANSON demonstrated the parasite of malaria to Ross, quickly removed from his mind all doubts as to its authenticity and explained to him his views on the method of spread of the disease. After long thought and observation in China, similar to that which led him to investigate the relationship of mosquitoes to filariasis, MANSON had formed the opinion that the intervention of a mosquito in the life-cycle of the malarial parasite was the only hypothesis which would explain what was known of the disease. This opinion, which amounted to a conviction, MANSON imparted to Ross. He pointed out to him where his great opportunity lay and fired him with enthusiasm and determination to investigate the subject immediately on his return to India. Accordingly in

1895 Ross commenced work at Secunderabad with little, if any, knowledge of the habits or external characters of mosquitoes and certainly none whatever of the internal anatomy or the method by which this could be studied. There being no schools of tropical medicine in those days such knowledge was not attainable, but Ross, perhaps hardly realising the difficulties before him, collected mosquitoes or hatched them from larvæ, fed them on malarial patients, invented for himself methods of mosquito dissection and identified as far as possible the nature of the various structures encountered. In 1895 he observed flagellation of the male crescent in the contents of the stomach of the mosquito and on 20th August, 1897, discovered on the stomach wall of certain dappled-winged mosquitoes—mosquitoes which he subsequently thought must have been *Anopheles stephensi*—small round cysts which, on account of the pigment granules they contained, he correctly surmised had been derived directly from the malarial parasites previously ingested from the blood of man. An account of these cysts, which he saw on a number of occasions, was published in the *British Medical Journal* of 18th December, 1897. After further work with mosquitoes and the observation that the cysts increased in size with increase in the interval between feeding and dissection, the investigation was brought to a sudden end by Ross being dispatched on 26th September, 1897, from Secunderabad to Kherwara on military service. Here an attempt was made to continue the work but with little success. It was not till the following year, as a result of MANSON's intervention in London with the Secretary of State for India that he received a special appointment to enable him to continue his malaria studies. He immediately set out from Kherwara for Calcutta, which he reached on 18th February, 1898. Work was resumed with at first comparatively little success though the pigmented cysts were once again found in one mosquito which had fed on a crescent case.

Meanwhile, at the end of 1897 MANSON had informed Ross of MACCALLUM's discovery of the function of the flagellating body and flagella, new knowledge which rendered it no longer necessary to attempt to trace the flagella in the body of the mosquito, and still further convinced Ross that his pigmented cysts were derived from the malarial parasites. Indeed he saw at once that the cysts were zygotes produced by the penetration into the tissues of the vermicules resulting from the fertilization, in the mosquito's stomach, of the female by the male gamete.

Owing to the difficulty of obtaining satisfactory cases of malaria and a sufficient number of the type of mosquito which had given such good results at Secunderabad, Ross, following a suggestion by MANSON, turned his attention to bird malaria. On 20th March the pigmented cysts were encountered in mosquitoes—presumably *Culex fatigans*—which had fed on larks infected with proteosoma. The increase in size of the cysts was again noted, and finally when the work was resumed after some weeks holiday in the Himalayas, the development of the cysts was followed till there appeared within them what Ross called



From Ross's "Memoirs" (John Murray).

RONALD ROSS, 1908

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germinal rods. It was discovered that the cysts ruptured and that the liberated germinal rods in the body cavity of the mosquito made their way to the thorax and there entered certain cellular structures which were correctly identified as salivary glands. The ducts of these glands were traced to the head and proboscis and the inference became irresistible that the germinal rods were infecting agents to be injected into the vertebrate host with saliva when the mosquito fed. Then came the final demonstration of the truth on 9th July, 1898, when two previously healthy birds, on which infected mosquitoes had been fed on 1st July, were both found to have malarial parasites in their blood.

Thus in the face of considerable opposition and difficulty and far removed from books of reference or outside aid other than that given in MANSON'S numerous letters, was accomplished a piece of work remarkable not only for its novelty and intricacy, but also for its completeness. A method of mosquito dissection had been elaborated; the various organs had been identified and their normal structure noted; naturally occurring parasites of these insects had been studied and excluded from any possible cycle of the malarial parasite, which itself was traced from the blood of the bird to the salivary gland of the mosquito, with such accuracy that subsequent research has added to Ross's description little more than details resulting from more refined technique. One is led to wonder whether Ross would have achieved so much had he been better trained in more orthodox methods of research. His want of special knowledge drove him to work out his own salvation and gave scope for that genius which he undoubtedly possessed. Throughout his work he was in regular correspondence with MANSON who urged him on with encouragement and advice, and on more than one occasion prevented him from abandoning the quest. Ross duly acknowledged his great indebtedness to MANSON without whom, as he has admitted, he would never have accomplished the task. It is equally true that without ROSS, MANSON would probably never have had a share in the discovery which he announced on Ross's behalf at a memorable meeting of the British Medical Association in Edinburgh on 28th July, 1898, the proceedings of which were published in the *Lancet* of 20th August, and more fully in the *British Medical Journal* of 24th September of the same year.

The cycle of the malarial parasite of Calcutta birds in the mosquito having been disclosed, Ross took it for granted that the human malarial parasite would have a similar cycle, the early stages of which he had seen in 1897. It was not, however, his lot to demonstrate this cycle, for immediately after the completion of the proteosoma work he was ordered away from Calcutta to investigate kala-azar, the nature of which was then quite unknown. GRASSI and other observers in Italy took up the malaria investigation and proved in December, 1898 and the succeeding few months that the human malarial parasites passed through the same cycle of development in anopheles mosquitoes and were transmitted by them from man to man. The Italian observers must have been

cognisant of Ross's work published fully in the *British Medical Journal* and *Lancet* a few months before, but they unfortunately employed the word *indipendente-mente*, which Ross interpreted as a claim that their work had been carried out entirely without reference to his own. It hardly seems possible that the Italian workers could have made such a claim, for it is inconceivable that they were unaware of the proceedings of the meeting in Edinburgh and the accounts of it which had appeared in the medical press. It seems more probable that the word referred only to some part of the investigation. Whatever may be the exact explanation, this was the starting point of an unfortunate literary warfare between ROSS and GRASSI which continued relentlessly and often bitterly for twenty or thirty years.

There is no doubt that ROSS, with nothing to guide him, discovered the complete cycle of development of a malarial parasite in a mosquito, a cycle which was not even dreamed of before he began his work and the disclosure of which was nothing short of a revelation. He saw the early stages of this cycle in the case of one of the human malarial parasites and left the investigation at such a stage that it was a relatively simple matter, as it is to-day, for anyone who knew his work and exactly what to look for in mosquitoes to trace the complete cycle for any of the malarial parasites of man. This was accomplished easily by GRASSI and his collaborators whose chief claim seems to be that they definitely associated the human parasites with anopheles mosquitoes, though even here ROSS had already realised that certain mosquitoes allowed development of the human parasites and others did not.

In recognition of ROSS's share in the solution of the malaria transmission problem he was awarded the Nobel prize for medicine in 1902, an award which, however just, was not sufficient to close the bitter controversy about priority.

ROSS left India early in 1899 and finally retired from the Indian Medical Service on 21st July of that year with the rank of Major. He was appointed Lecturer in Tropical Medicine to the newly founded Liverpool School of Tropical Medicine, a post which was elevated to a professorship in 1902, and which he held till 1912 when he came to London. He retained his connection with the Liverpool School, however, for another five years as Professor of Tropical Sanitation. In London he was appointed Physician in Tropical Diseases to King's College Hospital and commenced consulting practice in Cavendish Square, a venture which he quickly abandoned.

During the years following his return from India ROSS conducted various expeditions to malarious countries with a view to studying the association of malaria with anopheles mosquitoes and the possibilities of malaria reduction by attacks on mosquitoes, a problem which was ever in his mind and which he never wearied of preaching to sanitary authorities at home and abroad. Thus he visited Sierra Leone (1899-1900), West Africa (1901-1902), Mauritius (1907-1908) and Spain, Cyprus and Greece (1912). These expeditions enabled him to demonstrate the association of anopheles mosquitoes with malaria,

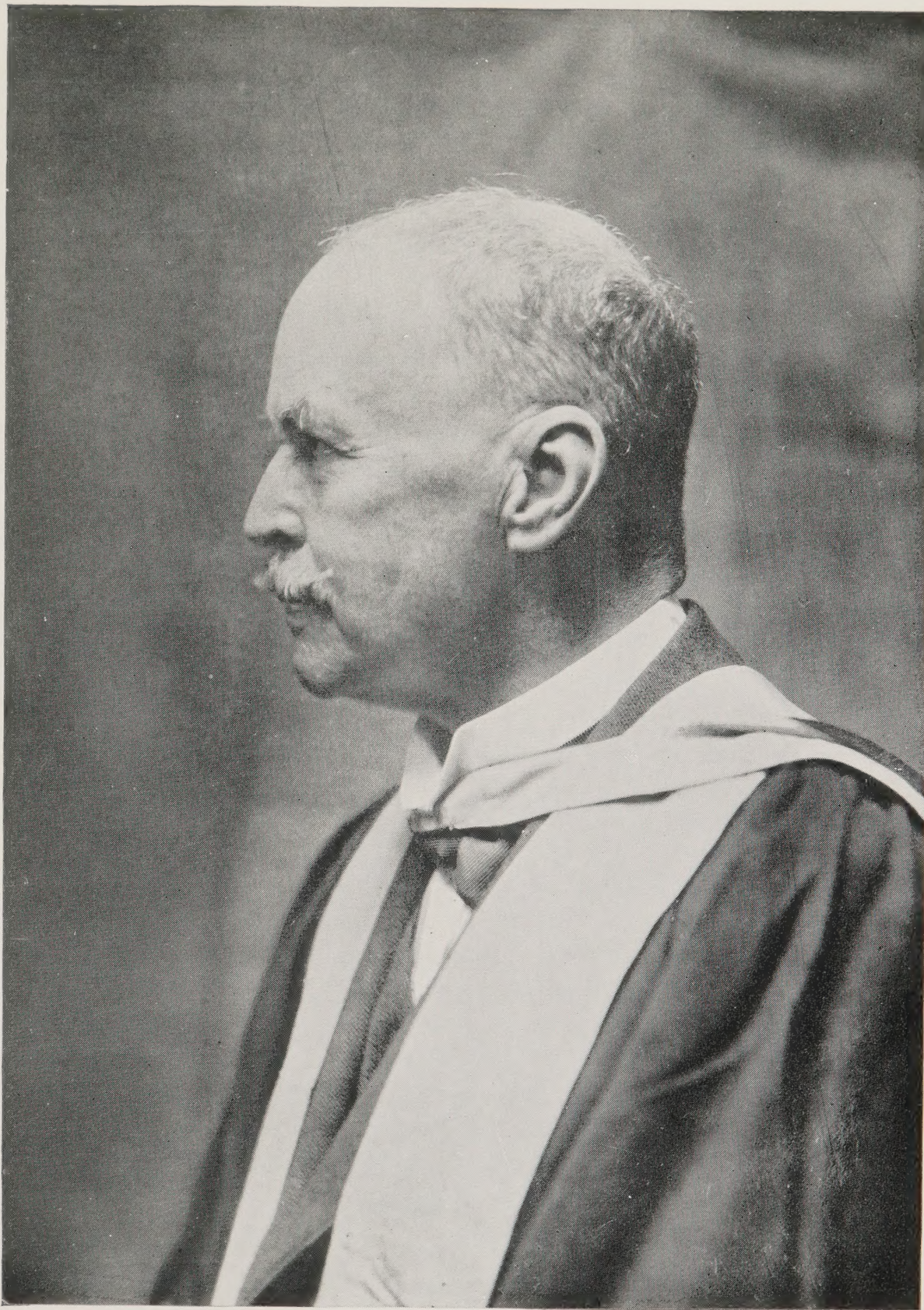


Photo : Haines.

RONALD ROSS, 1926.

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but failed to convince the local authorities that anti-mosquito measures should be at once taken up. On this account, though the one great scientific achievement in India had placed him in the forefront of medical science and gained for him the Nobel prize and numerous other honours and awards, he was far from satisfied. He felt there had been unjustifiable reluctance on the part of the Government to launch out immediately into schemes of mosquito reduction or to give him an administrative post to enable him to carry out his schemes himself. His impatient endeavours to force administrations to his way of thinking, and the controversies with departments and individuals in which he had engaged, had produced the impression that he was a difficult person to deal with and largely accounted for the fact that the outbreak of the Great War found him without definite occupation.

Though no physician in the true sense of the term, he was appointed Consulting Physician in Tropical Diseases to the hospitals for Indian troops in England. In the following year he was sent on a fruitless expedition to Alexandria and Salonika in connection with the prevalence of dysentery amongst troops invalided from Gallipoli. Later, in 1917, he was given a position as Consultant in Malaria to the War Office and went again on a brief visit to Salonika. On his return he occupied a room at the War Office and with the rank of Colonel busied himself with questions relating to malaria amongst troops invalided home from abroad. On his demobilization in September, 1919, with the rank of Colonel in the Territorial Force Reserve of the Royal Army Medical Corps, he continued his connection with malaria as Honorary Consultant for this disease to the Ministry of Pensions.

Certain of Ross's admirers were of opinion that an Institute for Research in Tropical Medicine should be established in his honour. A committee was formed and appeals for funds by public subscription resulted in sufficient being obtained to purchase a property on Putney Heath. This was adapted to form a small hospital of a dozen beds and a few laboratories and was opened as the Ross Institute by H.R.H. The Prince of Wales on 25th July, 1926. Ross was the first Director-in-Chief, a post he held till the time of his death. At the Institute bearing his name he was daily to be found in his office where he occupied his time in receiving visitors and discussing with them the problem of malaria reduction, and working on his manuscripts relating to malaria, mathematics, poems and romances, several of which he found time to publish.

In 1926 Ross made a journey to the East and attended, at the Presidency General Hospital in Calcutta, on 7th January, 1927, a historic ceremony which took the form of the unveiling of a gateway erected to commemorate the great discovery he had made in a small laboratory not more than seventy yards away.

In May, 1929 the Ross Award Fund was started and the public invited by certain medical men and scientists to contribute to the fund as a token of their appreciation of the value of Ross's work. Though he had sufficient income to

give him the ordinary comforts of life, he was far from being a wealthy man, and there were those who considered that the British Government should have rewarded him with a substantial pension. The sale of his note books, manuscripts and other papers relating to his discovery, which are now in the keeping of the Ross Institute, increased his income to a slight extent. This was still further augmented by the Award Fund which realized by September, 1932, when it was closed, the sum of £15,513.

RONALD ROSS was born at Almora in the Kuaon Hills in India on 13th May, 1857, just before the outbreak of the Indian Mutiny. His father was General Sir CAMPBELL ROSS, K.C.B., of the Bengal Staff Corps, who at the date of Ross's birth at Almora was stationed there as Captain in the 66th Gurkha Regiment. Ross received his medical education at St. Bartholomew's Hospital where he showed, as he himself has said, little interest in medicine. He nevertheless secured the membership of the Royal College of Surgeons five years after entering the hospital, but failed for the L.S.A. He then went to sea as a surgeon in the Anchor Line and succeeded in obtaining the L.S.A. two years later, after which he presented himself for the Indian Medical Service securing at the examination the seventeenth place out of twenty-two vacancies.

His commission in the Indian Medical Service dated from 2nd April, 1881. After fourteen years of military service the one great opportunity came to Ross who seized it with courage and determination in the face of considerable opposition and ridicule and raised himself from comparative obscurity to a pinnacle of fame. Other investigations which he attempted came to nothing. Indeed after his return from India in 1899 he gave up medical research, enthusiasm for which had, in his own words, been murdered by the polemics and controversies in which he had become involved. He turned his attention more and more to literary work and mathematics, a distinct leaning towards which he had displayed during his early service in India. He published various mathematical papers, novels, and volumes of poems in addition to articles and books dealing more directly with his work, such as his *Malarial Fever, Its Cause, Prevention and Treatment*, which appeared in 1902. Finally must be mentioned his *Memoirs* published in 1923, which gives a vigorous account of his life and work, which faithfully describes his hopes, ambitions and disappointments, and, to those who can read between the lines, throws more light on the character of this remarkable man than can be obtained from any other document.

For a complete list of his published works, the numerous honours and awards he received and many other details of his career readers are referred to the *Memoirs* and to obituary notices in the *British Medical Journal* for 24th September, the *Lancet* for 24th September, *The Times* of 17th September, 1932, and many other papers.

C. M. WENYON.

